

***Alloeocomatella*, a new genus of reef-dwelling feather
star from the tropical Indo-West Pacific
(Echinodermata: Crinoidea: Comasteridae)**

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Abstract.—*Alloeocomatella*, a new genus of comasterid feather star from tropical Indo-West Pacific reefs, contains two species: *A. polycladia*, a new species, and *A. pectinifera* (A. H. Clark), the latter reassigned from the genus *Comissia*. Both are cryptic during the day; at night they extend their arms for feeding or emerge completely. *Alloeocomatella* differs from other genera in the family Comasteridae in its pattern of development of first brachial syzygies, and in the structure of its oral pinnule combs. *A. pectinifera* has rays up to 500 mm long, the longest recorded for any extant feather star.

Recent collections of shallow-water crinoids from tropical western Pacific reefs include a new species of Comasteridae that cannot be assigned to any named genus. The species exhibits the same arm branching pattern as *Comatella* A. H. Clark, but differs in pinnule and cirrus structure, and in the placement of initial brachial syzygies. The latter changes with growth, a trait apparently unique among comasterids. In specimens with 11–20 arms, the first syzygy is as in *Comanthus* and several other genera. In specimens with >20 arms, placement of syzygies approaches that of *Comatella*. Comparison with co-occurring *Comissia pectinifera* A. H. Clark indicates that the two species are congeneric. In fact, specific assignment of small ten-armed specimens is problematic. The two differ substantially from the type species of *Comissia* (*C. luetkeni* A. H. Clark) and so warrant a new genus.

Material used in this study is housed in the National Museum of Natural History, Smithsonian Institution (USNM), British Museum (Natural History)(BMNH), Museum national d'Histoire naturelle, Paris (PM), Los Angeles County Museum of Nat-

ural History (LACM), and the Institut Royal des Sciences naturelles de Belgique (BELG). Terms, abbreviations, measurements and symbols are as follows: Centrodorsal: central aboral plate. Cirri: aboral, segmented hooks attached to centrodorsal; Roman and Arabic numerals indicate numbers of cirri/individual and segments (cirrals)/cirrus, respectively (a range of values is usually given); LW of cirral: length to median width ratio (:1) when viewed laterally. Ray: one of five branched series of ossicles radiating from center of specimen; three rays arising closest to the mouth (displaced to one side of visceral mass in comasterids) are anterior. Radial: (n.) first ossicle of a ray or (adj.) a structure associated or oriented with a ray. Axil: ossicle at which a ray branches. Brachitaxis: series of ossicles following radial or axil and including the next axil; I-IIIBr: first through third brachitaxes; Arabic numeral immediately following indicates number of ossicles in that brachitaxis (e.g., IIBr2). Arm: unbranched series of ossicles following distalmost axil; brachial (br; plural, brr): arm ossicle; subscript numbers indicate specific ray ossicle (brachitaxis or arm) counting from first os-

sicle after preceding axil or radial (e.g., IIBr₂, br₇); WL of ray ossicle: median width to midaboral length ratio when viewed aborally. Synarthry: articulation between first two ossicles of a brachitaxis or arm consisting of two ligament bundles separated by an aboral-oral fulcral ridge, sometimes with midaboral swelling. Syzygy (+): articulation between two successive ray ossicles consisting of radiating ridges and grooves and appearing externally as a perforated line (e.g., br₃₊₄); intersyzygial interval: number of articulations between successive syzygies. Pinnules (P): unbranched segmented appendages arising from alternate sides of successive brachials; subscripts count pinnules from the most proximal; numbers and letters refer to pinnules along exterior and interior side of an arm, respectively (that is, the sides away from and toward the extrapolated axis of the ray) (e.g., P₄, P_C); LW of pinnule ossicles (pinnulars): length to median width ratio. Comb: modification of distal pinnulars of proximal (oral) pinnules producing comblike profile. Disk: central visceral mass or, specifically, its oral surface; anal interambulacral area: large area on disk surrounded by food grooves and bearing anal papilla. For further discussions and examples of comatulid morphometrics, meristics, abbreviations and symbology, see A. M. Clark & Rowe (1971), Breimer (1978), Hoggett & Rowe (1986) and Messing & Dearborn (1990). In all illustrations, sparse uniform stippling indicates articulations.

Genus *Alloeocomatella*, new genus

Diagnosis.—A genus of Comasteridae with all brachitaxes of two ossicles articulated by synarthry; arms 10–30, always arranged in single plane (rays never twisted); when present, IIIBr series developed exteriorly; first syzygy at br₃₊₄ on arms arising from IBr series; in specimens with <20 arms, first syzygy also chiefly at br₃₊₄ on arms arising from IIBr series; in specimens with ≥20 arms, syzygies at br_{1+2,3+4} or br₃₊₄

on arms arising from IIBr, and chiefly br_{1+2,3+4} on interior arms and br₃₊₄ on exterior arms arising from IIIBr; br₁₊₂ occasionally present alone; middle brr with raised axial lines; oral pinnule combs long, of 20–37 teeth, occurring from P₁ to between P₄ and P₈; teeth confluent with lateral margin of pinnular, ≥2× taller than their greatest width at mid-comb, remaining tall to pinnule tip, and arising from side of pinnular away from arm; proximal tooth not transverse; basal carinae absent; cirri up to 26 segments, cylindrical proximally, compressed and wider distally; transitional and following cirrals with transparent distal rim, and with distally-directed midaboral spine located distally or subdistally initially, gradually moving to middle of segment and becoming more erect on more distal cirrals; spine usually sharp, sometimes blunt on large cirri, sometimes broadened as a narrow transverse ridge, occasionally forked (especially opposing spine); mouth eccentric; anal papilla close to mouth.

Type species.—*Alloeocomatella polycladia*, new species.

Other included species.—*Comissia pectinifer* A. H. Clark, 1911.

Distribution.—Maldiv Islands, Christmas Island (Indian Ocean), Indonesia, New Guinea, Bismarck Archipelago, Great Barrier Reef (Lizard I.), Fiji, Palau, New Caledonia, Chuuk Atoll. From 3 to at least 25 m [one record of 100 m (A. H. Clark 1931)].

Etymology.—From the Greek *alloios* (αλλοιος) “of another kind, different” (Brown, 1978) and *Comatella*, a comatulid genus that it resembles. Gender is female.

Remarks.—Both species of *Alloeocomatella*, when handled alive, are less “sticky” and more flexible than many other comasterids; lack of stickiness is perhaps due to relatively weak development of spines and hooks on distal pinnulars.

Features of *Comatella* distinguishing it from *Alloeocomatella* are as follows: arms 10 to >80; rays in single plane or twisted, with exterior branches curved to oral side

of radial plane; first syzygy at br_{1+2} on arms arising from IIBr and following brachitaxes with one exception: first syzygy at br_{3+4} on exteriormost arm of IIIBr and following brachitaxes; br_{3+4} often absent following br_{1+2} , even in specimens with 40 arms. Single confluent comb teeth arising from interior side of pinnule (side closest to arm); individual teeth $<2\times$ taller than greatest width at mid-comb, usually 14–18/comb, and strongly reduced on last one or two pinnulars; sharp rounded carina usually present on basal segments of proximal pinnules. Cirri bearing aboral transverse ridges (sometimes shallow V- or Y-shaped in aboral view), sometimes narrowing to erect rounded or triangular prominence or spine on more distal cirrals.

The type specimen of *Comissia luetkeni* A. H. Clark, the type of *Comissia*, differs from *Alloeocomatella* as follows: cirri stout; aboral distal margins of all but basal and distal few cirrals strongly flared and sometimes dentate; IBr2 series and arm bases as far as br_2 closely apposed and flat-sided; no raised axial lines on brr; pinnule combs of fewer than 20 teeth, arising abruptly on all oral pinnules; most pinnulars of middle and distal pinnules with strong distal spine; distal pinnulars with $LW \leq 3.0$; mouth subcentral; anus marginal.

Alloeocomatella polycladia, new species
Figs. 1–2, 3a–d, h, 4

Comatella maculata.—Meyer & Macurda, 1980, pp. 63, 68, 83, 96 (part); Meyer, 1986, pp. 203, 208–209 (part?).

Diagnosis.—A species of *Alloeocomatella* with up to 30 arms; ray length up to 205 mm; anterior:posterior ray length ratio 1.1–1.5:1; longest segments on distal pinnules with LW usually 3.0–5.0; longest cirrals (on mature cirri) with LW 1.3–2.0; anal interambulacral area usually crowded with rounded or irregular, knobbed or molari-form nodules, but not often on anal papilla

itself. [Small ten-armed specimens may have more elongated cirrals and distal pinnulars.]

Type series.—Holotype: USNM E44632, N side of Northeast Pass, S of Quoi I., Chuuk Atoll, Federated States of Micronesia, $7^{\circ}31'32''N$, $151^{\circ}58'11''E$, ≈ 18 m, 11 Jun 93, night. Paratypes: Chuuk Atoll: USNM E44633 (1 specimen) N side of NE Pass, S of Quoi I., ≈ 18 m, 11 Jun 1993, night. USNM E44636 (1), N side of NE Pass, S of Quoi I., 9–18 m, 11 Jun 1993, night, Patrick Colin, coll. USNM E44634 (1), N side of NE Pass, S of Quoi I., 6 m, 8 Jun 1993, Larry Sharron, coll. BMNH 1994.5850 (1), barrier reef S of Otta I., $07^{\circ}08'45''N$, $151^{\circ}53'11''E$, 11 m, 9 Jun 1993. LACM 93-95.1 (1), barrier reef S of Otta I., 9 m, 9 Jun 93, Larry Sharron, coll. Papua New Guinea: PM ECCh-16 (1), fringing reef, N side Nagada Harbor, Madang, $05^{\circ}09'29''S$, $145^{\circ}49'21''E$, 9 m, 10 Jul 1991, night. USNM E44642 (1), Nagada Harbor area N of Madang, no field data, Jul 1991. USNM E44635 (1), fringing reef drop off, Cape Croisilles, $4^{\circ}51'30''S$, $145^{\circ}48'E$, ≈ 30 km N of Madang, 6 m, 13 Jun 1992, Bert Hoeksema, coll. USNM E44637 (1), barrier reef E of Wongat I., Madang, $05^{\circ}08'09''S$, $145^{\circ}50'51''E$, 3 m, 11 Jul 1991. (All collections by the author except where noted.)

Other material examined.—Caroline Islands: USNM E44770 (4 specimens), E34983 (2), E44693 (18), E44694 (21), Palau Is., D. L. Meyer, coll. Australia: USNM E44771 (3), E44768 (3), Lizard I., Great Barrier Reef, D. L. Meyer, coll. Fiji: USNM E44769 (2), D. L. Meyer, coll. Indonesia: USNM E35033 (1), Marsegoe I., N end of Ceram I., Moluccas ($2^{\circ}59'48''S$, $128^{\circ}03'E$), 15 m, D. L. Meyer, coll. Papua New Guinea: BELG-418 (1), Platier, Laing I., night, 23 Jul 1989, 20 m, M. C. Lahaye, coll.

Description of holotype.—Centrodorsal a thick pentagonal disk with sloping sides; diam. = 9.3 mm; aboral surface rugged with deep central depression and traces of former cirrus sockets. Cirri LXV, 21–25, 16–26 mm long, of variable length and robustness,

crowded two or three deep around centro-dorsal margin, with few sockets encroaching on aboral surface. First segment very short; second wider than long; third squarish; fourth or fifth to eighth, ninth or tenth cirrals longest, $LW = 1.3$, slightly constricted. Following cirrals gradually decreasing in length; cirrals in distal third of cirrus shorter than wide, $LW = 0.7$. Twelfth to fifteenth cirral (on larger cirri) transitional, shiny distally. Tip of sharp aboral spines occasionally finely divided into several tiny teeth. Antepenultimate cirral with transverse aboral ridge, sometimes with prominent ends forming a pair of spines. Spine on preceding cirral (fourth from end including claw) may also be slightly widened transversely. Opposing spine also a transverse ridge. Transverse ridges may be irregularly denticulate.

Anterior rays 150–160 mm, posterior rays 140 mm long. Arm number 30. Radials hidden by centrodorsal. Rays separated proximally; aboral surface of disk visible between adjacent rays. Brachitaxes with low midaboral synarthrial swelling straddling articulation of first and second ossicles. IBr_1 short, partly hidden by centrodorsal (mostly hidden by cirri). Axil (IBr_2) with very short, diverging lateral margins, $WL = 2.0$. $IIIBr$ uniformly developed exteriorly. II and $IIIBr_1$ and br_1 slightly longer exteriorly and united interiorly; articulations with low midaboral synarthrial swellings; each brachitaxis with gently concave lateral margin. Br_1 and br_2 (or br_{1+2}) longer exteriorly. Br_{3+4} oblong, $WL = 1.4$ – 1.7 , diam. = 1.9 – 2.1 mm. Br_{5-7} oblong, with well-developed alternating articular tubercles, $WL = 1.7$ – 2.0 . Br_{8-9} cuneate. Following brr triangular, $WL = 2.3$, diam. = 2.1 – 2.4 mm (slightly wider than arm base). Brr become shorter by mid-arm, very strongly cuneate or triangular, $WL = 2.6$ – 3.0 ; distal margins thickened (raised but not everted) and spinose; thickening best developed along middle portion of arm. Distal brr almost oblong (slightly longer on one side), $WL = 1.5$; thickening of distal margins reduced; spines present only mid-

aborally. Aboral surface of arms beyond the proximal several brr with numerous fine raised axial lines projecting beyond distal margin of ossicle as distal rim of spines; these spines fewer and midaboral on distal brr. On arms arising from $IIIBr$, syzygies at $br_{1+2,3+4}$ or br_{3+4} alone. Br_{3+4} on exterior arms and $br_{1+2,3+4}$ on interior arms arising from $IIIBr$. Following syzygy br_{15+16} to br_{19+20} . Next intersyzygial interval chiefly 4–5 (few 3); distal intersyzygial interval chiefly 3 (some 4, 5).

P_1 of 64 segments, 25 teeth, $L = 23$ mm; basal several segments shorter than wide; most segments about as long as wide, with distal rim of spines best developed on side of pinnular facing arm tip (when pinnule extends outward from arm); middle and distal pinnulars also with cluster of spines on side of pinnular facing arm tip; lateral spines consolidating to form rudimentary proximal comb teeth; comb teeth tall, narrow and usually triangular. P_2 and following oral pinnules similar to P_1 but decreasing in length through last comb-bearing pinnule (P_7 – P_8); with comb teeth developing more abruptly, few middle pinnulars longer than wide (LW to 1.3), and comb occupying relatively more segments per pinnule. P_2 of 54 segments, 33 teeth, $L = 16$ mm; P_3 of 45 segments, 27 teeth, $L = 13$ mm; P_7 of 30 segments, 20 teeth, $L = 9$ mm. P_8 or P_9 without a comb, 24 segments, $L = 9$ mm; basal segments short; most middle segments squarish to somewhat longer than wide, LW to 1.4 ; all segments except basal 3 with numerous spines on side of pinnulars facing arm tip. Middle pinnules (e.g., P_{20}) with 29 segments, $L = 14$ mm; similar to P_9 but more robust; segments with LW up to 1.4 . Distal pinnules much slenderer, with up to 28 segments, $L = 13$ mm; basal two segments short; following segments longer than broad (except near tip), becoming very slender in mid-pinnule, LW to 3.5 ; proximal segments with few distal spines; middle and distal segments with few weak lateral spines; last four segments with typical strong hooks.

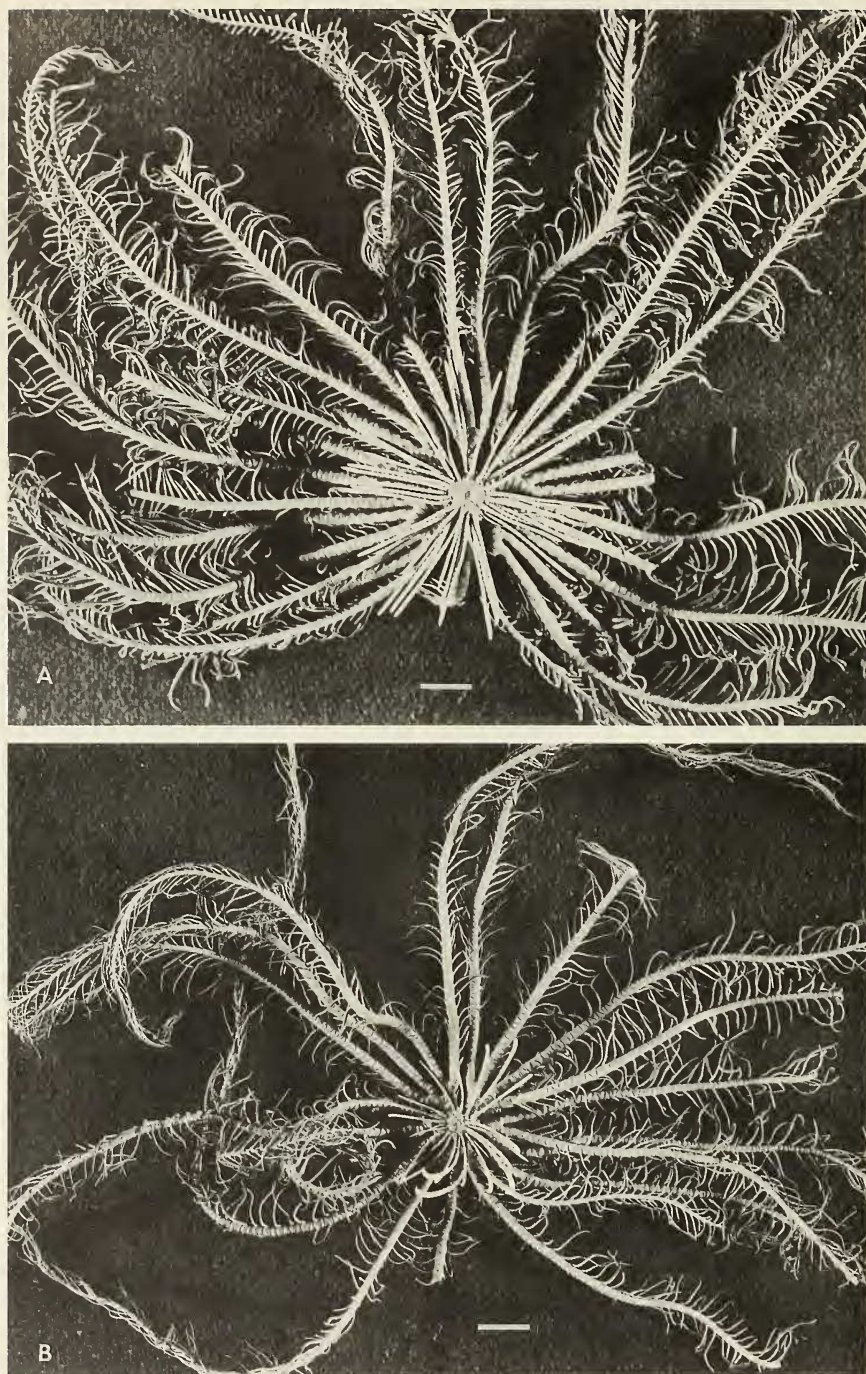


Fig. 1. *Alloeocomatella polycladia*, new species. a, holotype (USNM E44632), aboral view; b, paratype (LACM 93-95.1), aboral view. Scales: 1 cm.

Few large irregular nodules on large swollen anal interambulacral area; some almost foliose. Nodules more compact on anal papilla; some molariform. Anal papilla adjacent to mouth.

Other specimens.—One paratype (USNM E44633) collected with the holotype and three collected by D. L. Meyer at Lizard Island (USNM E44771) as large or larger than the holotype: centrodorsal diameter 9–10 mm; cirri LX–LXX, the largest with 24–25 segments, 23–27 mm long; ray length 150–205 mm; arms 28–30; P_1 up to 63 segments.

Most material smaller: 15–21 arms, ray length 105–150 mm (mostly <125 mm), and centrodorsal diameter 5.5–7.0 mm. Anterior:posterior ray length ratio 1.3–1.5:1. Central aboral depression shallower on smaller specimens. As in the holotype, cirri usually varying substantially in length, number of segments and robustness in individual specimens; chiefly XXXV–LV, with largest cirri of 16–20 segments, 15–18 mm long. Longest cirrals usually fourth and fifth or sixth, with LW = 1.5–2.0 (to 2.3 on smaller cirri).

P_1 usually 43–54 segments, 22–30 teeth, 14–20 mm long. P_4 or P_5 usually the last comb-bearing pinnule. Middle and distal pinnules correspondingly smaller than those of holotype (e.g., middle pinnules with 21 segments, 9 mm long; distal pinnules with 24–25 segments, 11–12 mm long). Middle pinnules of 20–21 segments, 9.0 mm long, not especially more robust than more proximal (non-combed) pinnules; LW of middle pinnulars up to 1.7. Distal pinnules differing from those of holotype in having one or few strong distal spines on both proximal and middle pinnulars, LW = 2.7–5.0, and only 0–3 weak lateral spines on distal few pinnulars (not including distal hooks).

Anal interambulacral area often crowded with rounded or irregular nodules except on anal papilla itself. Nodules usually with a knob; several sometimes coalesced into larger ridged or molariform structures,

sometimes forming an irregular pavement. Nodules sometimes also present on several small peripheral interambulacral areas. Oral surface completely naked in a few specimens.

Smaller ten-armed specimens differ as follows: centrodorsal diameter 2.9–4.6 mm; central depression slight or absent; ray length up to about 110 mm; cirri usually XXIX–XXXVI (rarely less), the largest of 16–19 segments; longest cirral with LW = 1.7–2.6; only the opposing spine widened or forked; segments of distal pinnules with LW to ≈ 6.0 .

Two small specimens from Palau have 6 rays and 12 arms.

Description of an immature specimen.—(USNM E44693) Centrodorsal a thin disk, 3.0 mm across; aboral surface slightly convex, without central depression; cirri XXIII, 12–16, 11.4 mm, third to sixth segments elongated with expanded ends, fourth to fifth or sixth segments longest, with LW = 2.2–2.4 (3.0 on a much smaller cirrus); sixth or seventh segment transitional, shorter and wider, LW = 1.6; distal several segments slightly wider than long; opposing spine slightly widened transversely.

Most rays broken; anterior ray 65 mm, posterior ray ≈ 45 mm; radials visible in interradian angles; IBr_1 completely exposed, oblong, WL = 2.2; axil pentagonal with diverging lateral margins, WL = 2.0; br_1 and br_2 oblong, WL = 1.7; br_1 united interiorly only proximally; br_{3+4} oblong, WL = 1.2, diameter = 1.0 mm; br_{5-6} oblong, WL = 1.3–1.4; following brr becoming cuneate, none triangular; middle brr cuneate, WL = 1.0, with distal margins raised, spinose, no axial lines; distal brr almost oblong, with few coarse midaboral distal spines; WL = 0.7.

P_1 of up to 35 segments, 19 teeth, 9.7 mm long; P_2 the last comb-bearing pinnule, smaller and slenderer than P_1 , up to 29 segments, 19 teeth, 7.6 mm long; P_3 , P_6 and P_4 much smaller and slenderer than P_2 not present on all remaining arms; middle pinnules of 15 segments, 6.1 mm long; distal

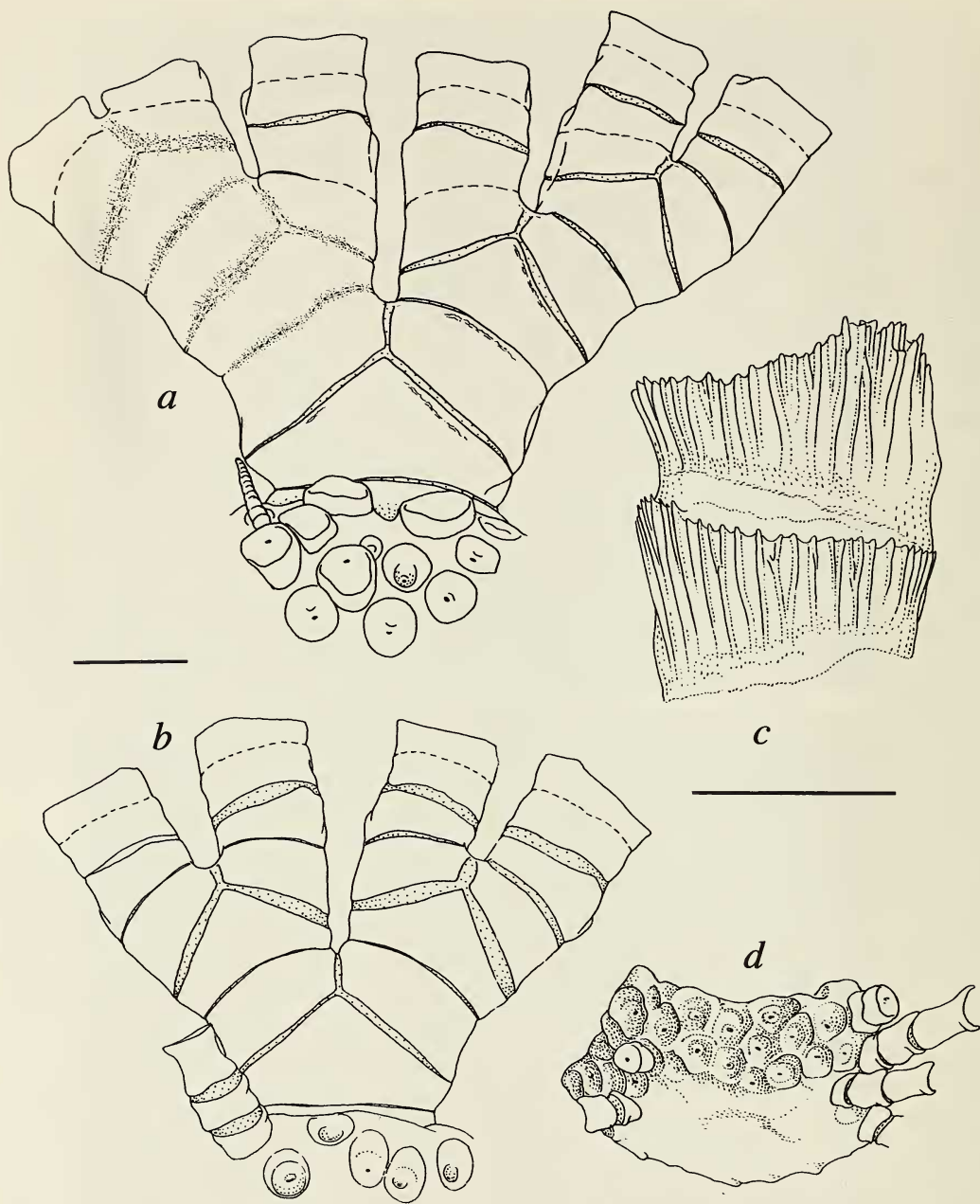


Fig. 2. *Alloeocomatella polycladia*, new species. a–b, margin of centrodorsal and base of one ray; a, large paratype with 30 arms (USNM E44633) (stippling on left side indicates reticulated tissue that obscures articulations; typical of proximal portions of rays of both species); b, smaller paratype with 20 arms (USNM E44636). c, two middle brachials showing raised axial ridges and distal spinose margins, paratype (PM ECCh-16). d, centrodorsal with several cirrus bases, oblique view, paratype (USNM E44637). Scale: (left) a, b, d, 2 mm; (right) c, 1 mm.

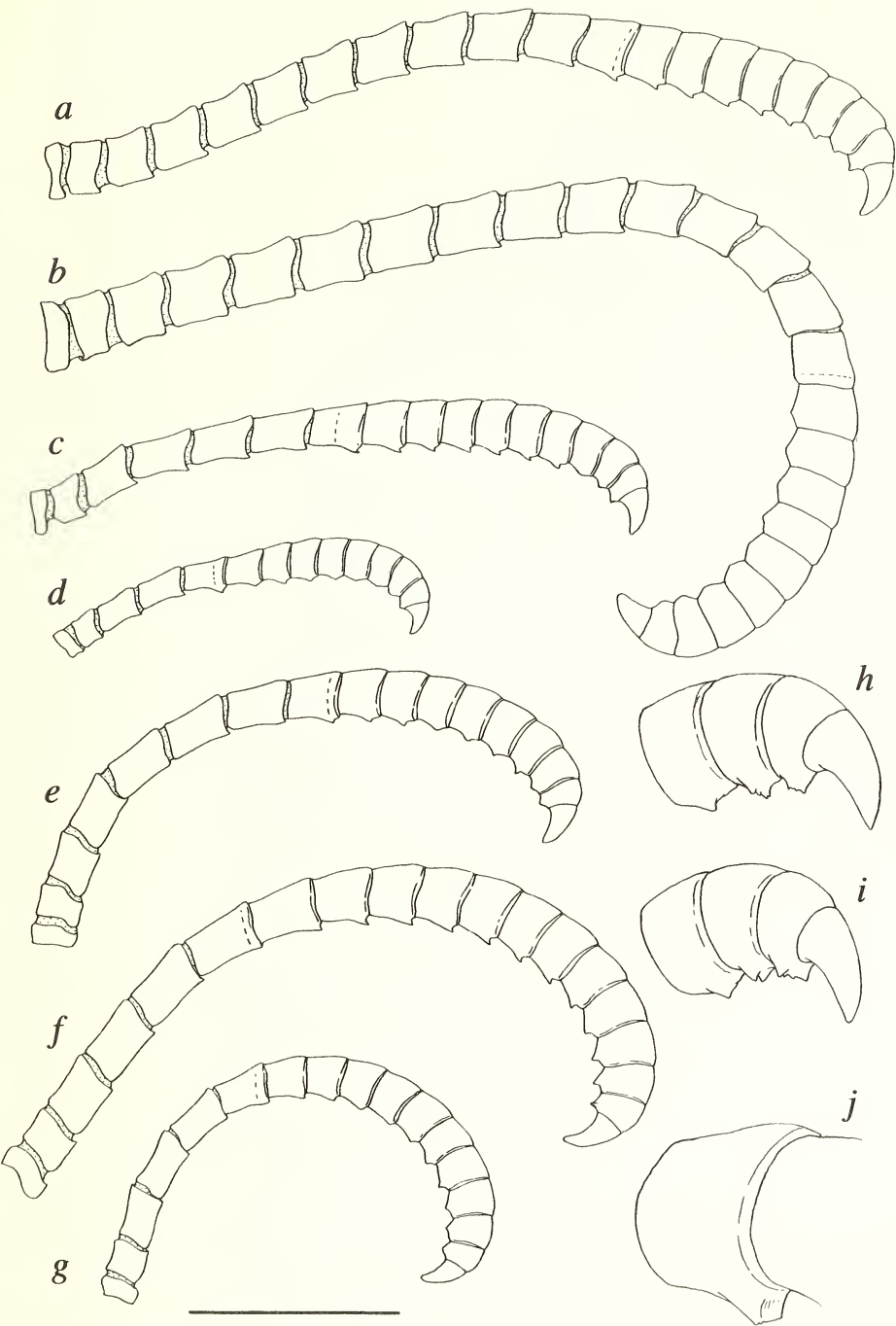


Fig. 3. Cirri. a-d, h. *Alloeocomatella polycladia*, new species. a-b, large paratype (USNM E44633); c-d, smaller paratype (USNM E44642); h, cirrus tip showing aboral spines on distal two segments (preceding terminal claw) widened as dentate transverse ridges. e-g, i, j. *Alloeocomatella pectinifera* (A. H. Clark). e, holotype (BMNH 87-4-26-9); f-g, (USNM E44640); i, cirrus tip showing forked aboral spine on antepenultimate cirral, and opposing spine widened as transverse dentate ridge; j, cirral following transitional cirral with aboral spine widened as sharp, narrow transverse ridge (LACM 92-160.1). Dashed lines (a-g) indicate transitional segments. Scale: a-g, 4 mm; h-i, 2 mm; j, 1 mm.

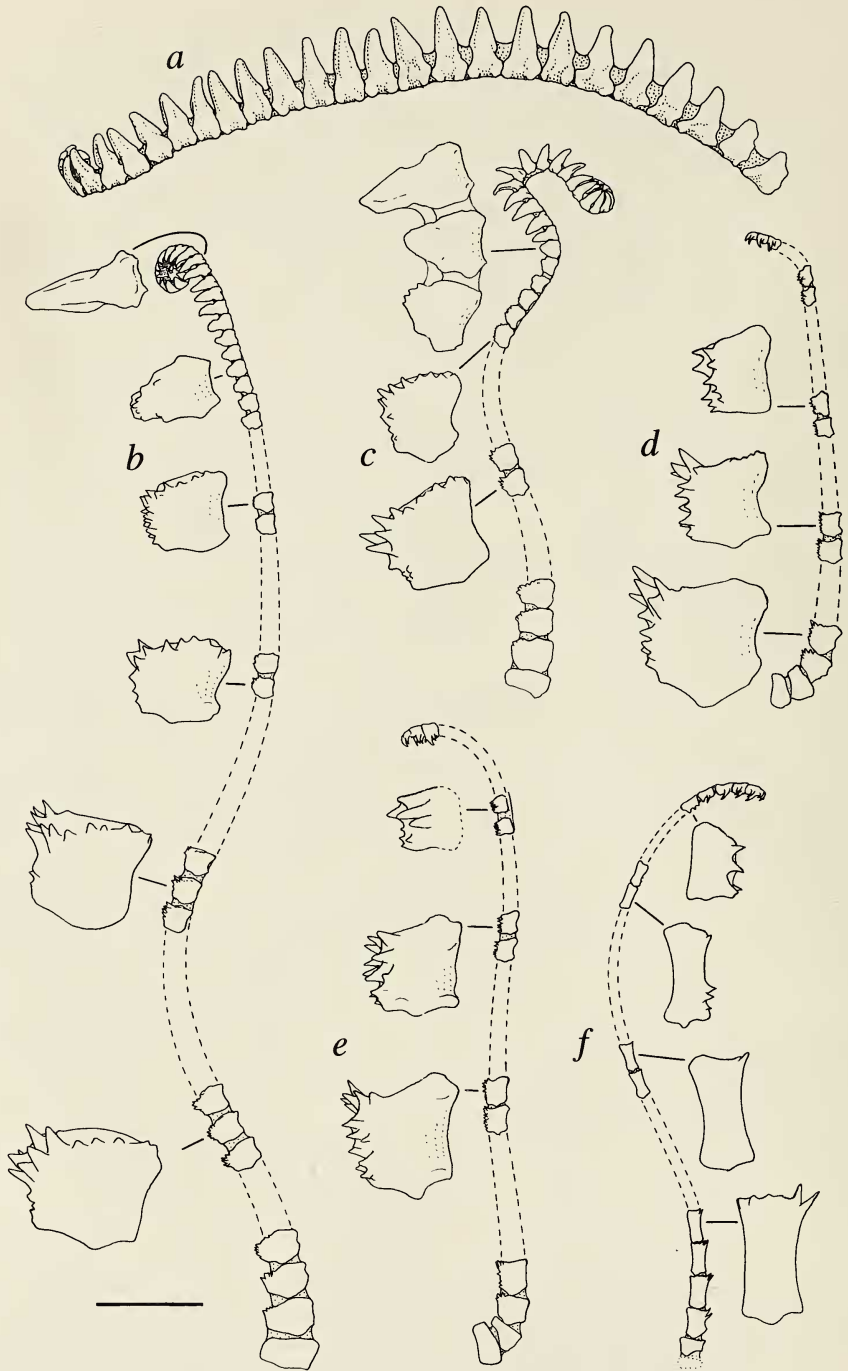


Fig. 4. *Alloeocomatella polycladia*, new species. a, comb of P_1 , paratype (PM ECCh-16); b-f, holotype (USNM E44632); b, P_1 ; c, P_3 ; d, P_9 ; e, P_{20} (dotted portion of distalmost enlarged pinnular obscured by tissue); f, P_{distal} (different arm) [first pinnular (dotted) lost]. Scale: 2 mm; enlarged pinnulars, 0.5 mm.

pinnules slender, up to 20 segments, 9.9 mm long.

Disk with numerous round nodules on anal interambulacral area.

Color pattern. — Dark red or purplish red; pinnules sometimes beaded purplish red and pink, sometimes with yellow, orange or pink tips.

Habits. — All specimens collected by SCUBA on inshore fringing reefs, lagoonal patch reefs, and barrier reefs. Cryptic during the day, often found curled under slabs of coral rubble. At night: specimens with about 20 or fewer arms concealed in crevices, with several arms extending into the water column and with pinnules arranged in single plane; withdrawing rapidly and completely when illuminated; large specimens completely exposed, perched on corals, forming arcuate or radial fan, also with pinnules arranged in single plane. The photograph identified as *Comatella maculata* on p. 208 of Meyer (1986) is almost certainly this species.

Distribution. — Indonesia (Ceram I.), Papua New Guinea, northern Australia (Lizard I., Great Barrier Reef), Palau Is., Fiji, New Caledonia, Chuuk Atoll; 3–18 m.

Etymology. — From the Greek *polys* (πολυσ) “many” and *klados* (κλαδος) “branch,” because this species has more than the ten arms of *A. pectinifera*.

Remarks. — In the past, specimens of *A. polycladia* have been identified as *Comatella maculata* due to similarities among brachitaxes, arm number and general cirrus structure in the two species (Meyer & Macurda 1980, Meyer, 1986). In Hoggett & Rowe's (1986) key to the genera of Comasteridae, large specimens (>20 arms; first syzygy on IIBr arms at br_{1+2}) run down to *Comatella* while smaller multibrachiate specimens (11–20 arms; first syzygy on IIBr arms at br_{3+4}) run down to either *Comanthus* or *Clarkcomanthus*. These smaller specimens lack the diagnostic features of either of the latter two genera and cannot be assigned to a genus using this key.

Several small specimens of *Alloeocomatella* collected by D. L. Meyer at Palau (included in USNM E44693, E44694) are difficult to assign to species. These individuals resemble *A. pectinifera* in having ten arms, and cirri and distal pinnules with more elongated segments. They are referred to *A. polycladia* because: 1) when measurable, the anterior:posterior ray length ratio is 1.1–1.5:1, less than in *A. pectinifera*, and 2) most specimens have large, crowded disk nodules except on the anal papilla itself. These specimens were also collected with larger specimens clearly identifiable as *A. polycladia*, but both species have been collected in the same local reef habitat. It is not surprising that small specimens may be difficult to identify. It is often impossible to identify juvenile ten-armed comasterids to genus (Hoggett & Rowe 1986).

Alloeocomatella pectinifera

(A. H. Clark, 1911),

new combination

Figs. 3e–g, i, j, 5, 6

Comissia pectinifer A. H. Clark, 1911, p. 644; 1912, p. 78; 1918, p. 19; 1931, p. 255–256, pl. 25. — Messing, 1994, p. 239.

Comissia pectinifera. — A. M. Clark & Davies, 1965, pp. 598, 603–4. — A. M. Clark & Rowe, 1971, pp. 6, 14. — Zmarzly, 1985, pp. 348, 350–2. — Meyer, 1986, p. 203. — Bradbury et al., 1987, pp. 190–191.

Comissia sp. cf. *pectinifera*. — Zmarzly, 1985, pp. 348, 351–2, 354–6. — Meyer, 1986, pp. 206–7.

Diagnosis. — Ten arms; anterior ray length up to 500 mm; anterior:posterior ray length ratio 2.0–2.9:1; longest segments on distal pinnules (anterior rays) with LW up to 7.0; longest cirrals (on mature cirri) with LW = 1.6–2.3; anal interambulacral area usually naked, with few scattered nodules, or with numerous nodules on anal papilla.

Holotype. — BMNH 87-4-26-9; Christmas Island, Indonesia (south of the Sunda

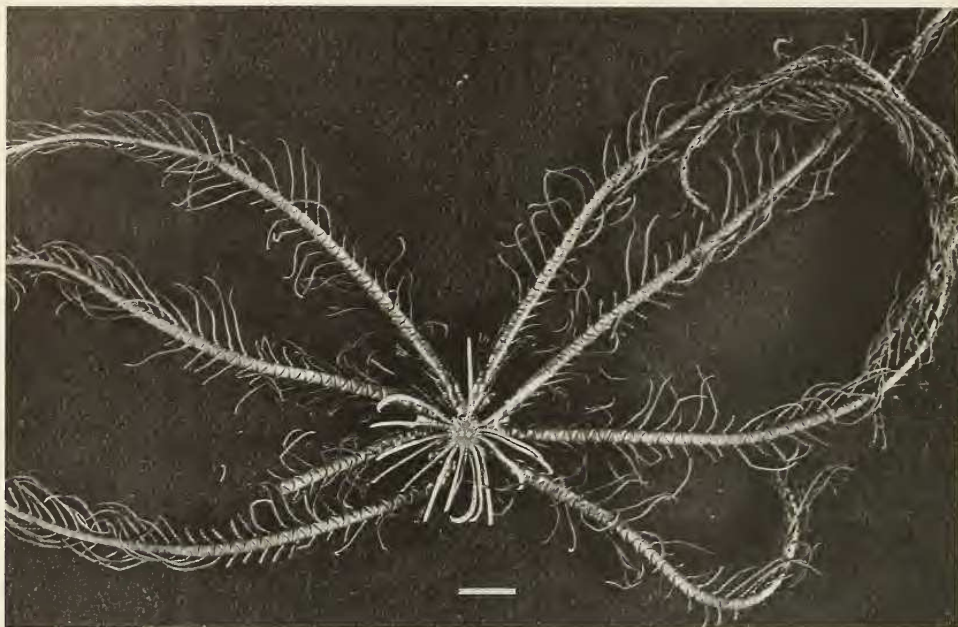


Fig. 5. *Alloeocomatella pectinifera* (A. H. Clark) (USNM E44640), aboral view. Scale: 1 cm.

Straits, between Sumatra and Java), H. M. S. Flying Fish (A. H. Clark, 1911, 1931).

Other material examined. — Chuuk Atoll: USNM E44802 (2 specimens), N side NE Pass, S of Quoi I., Chuuk Atoll, 7°31'32"N, 151°58'11"E, 18–23 m, 11 Jun 1993, P. Colin/C. G. Messing, coll. Papua New Guinea: USNM E44639 (1), fringing reef, N side Nagada Harbor, Madang, E of wading beach, 05°09'29"S, 145°49'24"E, 3 m, 4 Jun 1992. USNM E44638 (1), near top of barrier reef SE of Pig I., SE of Nagada Harbor, Madang, 05°10'21"S, 145°51'47"E, 14 m, 16 Jul 1991. LACM 92-160.1 (1), fringing reef, N side Nagada Harbor, Madang, 05°09'29"S, 145°49'21"E, 8 m, 12 Jun 1992. USNM E44640 (1), wall off Barracuda Rock, SE of Nagada Harbor, Madang, 05°10'20"S, 145°51'53"E, 23 m, 14 Jul 1991. USNM E44803 (1), near top of barrier reef SE of Pig I., SE of Nagada Harbor, Madang, 14 m, 16 Jul 1991. USNM E44804 (1 immature). Nagada Harbor area, Madang, no field data. USNM E44641 (1), Cape Croisilles,

exposed fringing reef, 4°51'30"S, 145°48'E, ≈30 km N of Madang, 6 m, 13 Jun 1992, B. Hoeksema, coll. Indonesia: USNM E8959 (2), Duroa Strait, Kei Is., 5°24'20"S, 132°55'E, 100 m, 15 Apr 1922, T. Mortensen, coll. (sta. 24). (All collections by the author except where noted.)

Description of holotype. — Poor condition; most rays broken near their bases. Centrodorsal a thick pentagonal disk with sloping sides, diameter = 4.6 mm; aboral surface with shallow central depression; cirri crowded around margin, 2–3 deep, XLIV, 14–17, maximum length 14 mm; segments increasing in length from very short first to fifth; fifth and sixth segments longest, LW = 1.9; following segments decreasing in length; seventh or eighth and following segments with sharp erect or distally-directed spine (blunt on some cirri); first spine-bearing segment with LW = 1.2, next as wide as long; following segments wider than long and becoming shorter distally; antepenultimate with LW = 0.7; spines on few distal

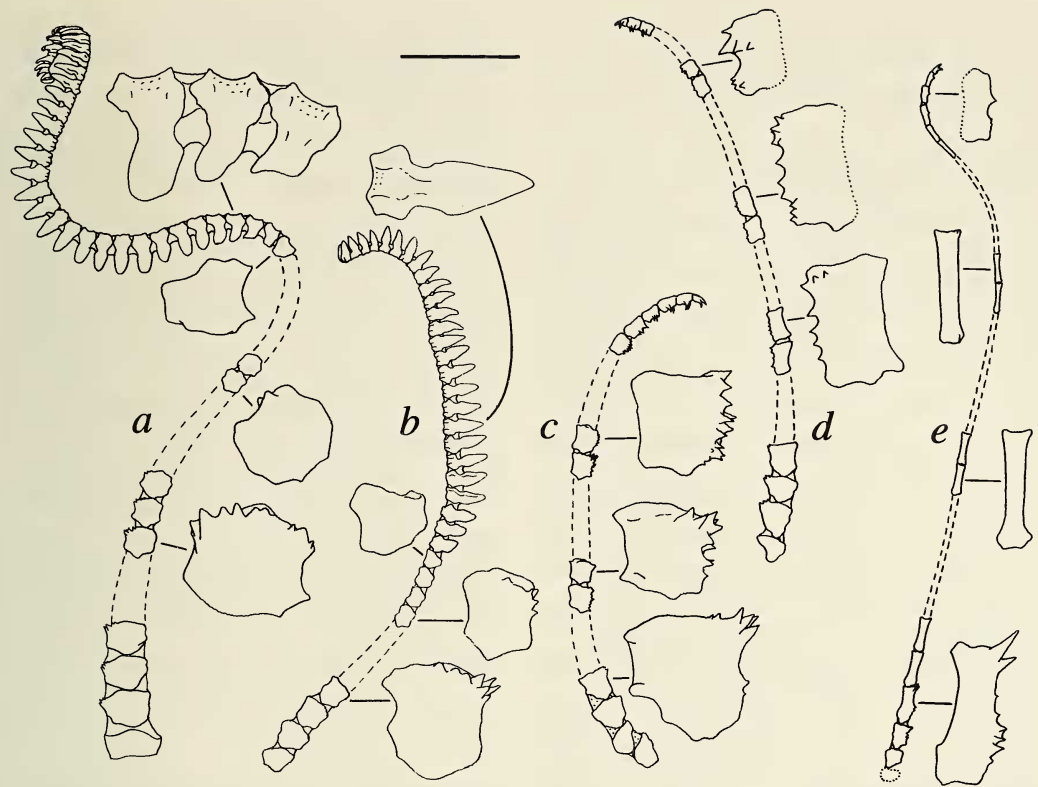


Fig. 6. *Alloeocomatella pectinifera* (A. H. Clark) (USNM E44803). a, P₁; b, P₅; c, P₉; d, P₂₀ (dotted portions obscured by tissue); e, P_{distal} [first pinnular (dotted) lost]. Pinnules taken from different arms. Scale: 2 mm; enlarged pinnulars, 0.5 mm.

segments, including opposing spine, sometimes widened as a transverse ridge which may be forked, dentate or serrate.

Radials visible in interradian angles; IB_{r1} short and separated, WL = 4.0; axils wider than IB_{r1}, with short, diverging lateral margins, WL = 1.8; br₁ oblong or slightly wider exteriorly, united interiorly only proximally, WL = 2.8; br₂ wider exteriorly, WL = 2.2; br₃₊₄ diameter = 2.0–2.2 mm; br_{5–6} oblong, WL = 2.3; proximal brr with strongly developed alternating articular tubercles; brr triangular or almost so by br_{8–9}, WL = 2.5; second syzygy at br₁₁₊₁₂; brr with thickened, raised, spinose distal margins and raised axial lines; middle brr strongly cuneate, WL = 1.7; distal intersyzygial interval 3. Most arms broken; longest intact to br₂₃.

Most pinnules broken. P₁ of 47 segments, with ≈ 26 tall narrow teeth, 15.3 mm long; comb developing gradually (comb coiled-tip may be lost; another P₁ bears 32 teeth); P₆ of 39 segments, about 27 teeth; comb developing more abruptly. Proximal and middle segments of oral pinnules short, with distal fringe of spines; middle segments also with few lateral spines coalescing on more distal segments to form comb rudiment. Middle pinnule of 22 segments, 9.3 mm long; segments beyond short basal few squarish or little longer than wide, with dense lateral cluster of spines.

Disk absent.

Description of other material.—Centrodorsal usually a thick rounded pentagonal or circular disk with steeply sloping sides; diam. = 4.1–6.1 mm; aboral surface with

shallow central depression and at least a trace of radiating interrarial ridges. Cirri crowded, of varying length and robustness, one or two deep around centrodorsal margin; XXIX–XLVI, 16–22 (mature), maximum length on any individual 12–19 mm (chiefly 13–16 mm); only one or two segments, from the fourth to seventh, longest; LW of longest segments on largest cirri = 1.6–2.3 (chiefly 1.8–2.0); sixth to eighth segment transitional; second segment following transitional, LW = 0.9–1.1; following segments slightly shorter; antepenultimate segment with LW = 0.6–0.8; aboral spine widened as a sharp narrow transverse ridge on some or most segments in some specimens; when present, transverse ridge may be forked (rarely trifid), eroded and blunt, or restricted to penultimate segment.

Maximum ray length chiefly 200–275 mm; anterior to posterior ray length ratio 2.0–2.5:1; one specimen with anterior rays 500 mm, posterior rays 200 mm; radials hidden or visible in interrarial angles; IB_{r1} short, oblong, separated or just touching proximally, partly hidden by centrodorsal or completely exposed, WL = 2.8–4.0; axil with short diverging lateral margins, WL = 2.0–2.2; IB_r and br₁₋₂ with or without small synarthrial swelling; br₁ oblong or slightly longer exteriorly, united interiorly at least partly, WL = 2.0–2.8; br₂ longer exteriorly, usually shorter than br₁, WL = 2.3–3.1; br₃₊₄ oblong, WL = 1.5–1.9, diameter = 1.6–2.4 mm; br₅ to br₆ or br₇ oblong, WL = 1.9–2.3; proximal brachials with moderately to strongly developed alternating articular tubercles; brr triangular by br₉₋₁₁, WL = 1.9–2.6; brr with raised, spinose distal margins and raised axial lines first appearing by br₇₋₁₁; brr strongly cuneate in proximal third of arm, WL = 1.8–2.4, becoming moderately cuneate by mid-arm, WL = 1.5–1.9, with raised, spinose distal margins and axial lines; distal brr moderately or weakly cuneate (almost oblong), often longer than wide, WL = 0.7–1.1, usually with distal margins weakly raised, spines strongest

midaborally, and axial lines weak or absent; brr near arm tip slender and elongated, WL = 0.5–0.8, with few coarse midaboral spines. Syzygies at br₃₊₄, usually br₁₁₊₁₂ to br₁₄₊₁₅ (rarely br₁₀₊₁₁ to br₁₆₊₁₇); distal intersyzygial interval usually 3 (sometimes 2 or 4; rarely 5 to 7).

Pinnules generally similar to those of *A. polycladia*. P₁ of 49–60 segments, 23–37 teeth, L = 18–26 mm; P₂ of 44–57 segments, 29–39 teeth, L = 13–20 mm; P₃ of 43–58 segments, 29–39 teeth, L = 12–18 mm; P₄ to P₆ the last comb-bearing pinnule, up to 42 segments, 31 teeth, L = 11 mm. P₉ of 22 short segments (max. LW = 1.3), up to 9 mm long; proximal segments (except basal two) with distal rim of spines; most segments with numerous spines on side of pinnule facing arm tip. Middle pinnules of 19–25 segments, L = 8–13 mm; similar to P₉ but with middle pinnulars more elongated; LW = 1.3–1.9. Distal pinnules up to 32 segments, L = 11–17 mm; basal two segments short; remaining segments (except near tip) elongate, LW = 3.0–7.0; proximal segments with one or two strong distal spines; most segments (especially on pinnules near arm tip) smooth with expanded ends; distal segments with one or two small mid-lateral spines; distal hooks weak.

Disk usually lost; when present, naked, or with few scattered conical nodules on anal interambulacrum; nodules numerous on anal papilla in one specimen.

Description of an immature specimen. — (USNM E44804) Centrodorsal a thin disk, 2.1 mm across; aboral surface slightly convex, with traces of juvenile sockets, and without central depression; cirri XXIV, 13–15, 10 mm; third to fifth segments elongated with expanded ends; fourth segment longest, with LW = 2.8–3.0; transitional sixth segment shorter and wider, LW = 1.6; distal several segments slightly wider than long; opposing spine slightly widened transversely on one or two cirri.

Anterior rays 130 mm, posterior rays ≈ 45 mm; radials just visible beyond centro-

dorsal; IBr_1 completely exposed, oblong, $WL = 2.0$; axil pentagonal with diverging lateral margins, $WL = 1.5$; br_1 and br_2 slightly longer exteriorly, $WL = 1.6$; br_1 united interiorly only proximally; br_{3+4} oblong, $WL = 0.9$, diameter = 0.9 mm; br_{5-6} oblong, $WL \approx 1.0$; following brr becoming cuneate, none triangular; middle brr cuneate, longer than wide, $WL = 0.7$, with distal margins raised, slightly everted, spinose and with spines strongest midaborally; no axial lines; distal brr slender, constricted in middle, with few coarse midaboral distal spines; $WL = 0.3$.

P_1 up to 43 segments, 29 teeth, $L = 10.7$ mm; P_2 smaller and slenderer than P_1 , up to 34 segments, 22 teeth, $L = 7.4$ mm; P_3 and P_c not developed; P_4 the last comb-bearing pinnule, much smaller and slenderer than P_2 , about 16–23 segments, 7–14 teeth, max. $L = 4.0$ mm; middle pinnules of 13–15 segments, $L = 5$ mm; distal pinnules extremely slender, up to 21 segments, $L = 9.2$ mm.

Disk naked.

Color patterns.—Rays variously deep red, red-orange, reddish- or pinkish gray, maroon or dark red-brown, often with differently pigmented articulations (red, orange or white), or a paler midaboral stripe. Some specimens with articulations and ossicle margins white. Pinnules same color as arms or darker, sometimes with paler or yellow tips, sometimes with white aboral stripe; in specimens with white-bordered ossicles, tissue dark brown on proximal pinnules, becoming orange or yellow on distal pinnules; centrodorsal sometimes with white center; cirri sometimes with white aboral stripe; disk dark red, red-brown, sometimes with narrow white stripes. At New Caledonia (Meyer 1986), yellowish or banded yellowish and brown, with brown pinnules.

Habits.—Cryptic during the day. At night, calyx remains hidden, with four to eight arms extended more or less in parallel; pinnules arranged in a single plane. Withdraws rapidly and completely when illuminated.

Distribution.—Maldivé Is., Indonesia,

northern Australia (Lizard I., Great Barrier Reef), Papua New Guinea, Palau Is., New Caledonia, Chuuk Atoll, Kwajalein Atoll. 3–23 m.

Remarks.—As mentioned under *A. polycladia*, small ten-armed specimens of *Alloeocomatella* may be difficult to identify to species. The greater difference between anterior and posterior ray lengths even in small specimens appears to separate *A. pectinifera* from *A. polycladia*. The nature and distribution of disk nodules should be used cautiously as a diagnostic character because specimens of both species may lack them.

Anterior:posterior ray length ratios vary within several comasterid taxa (Messing 1994), which suggests that this may not be a useful diagnostic feature. *Comanthus parvicirrus* (Müller), for example, tends to develop longer anterior rays and higher ratios in deeper and quieter habitats. Specimens from shallow (<8 m), higher-energy habitats tend to have rays of more nearly equal lengths. However, ray length ratio does not appear to vary with habitat in *Alloeocomatella*. At Madang and Chuuk Atoll, I found both species in the same local reef habitat and observed that both extend arms or emerge completely only under relatively low energy conditions, either in deeper water (14–23 m) or on shallow (3–4 m) sheltered inshore reefs. A single specimen from a shallow, high-energy habitat was cryptic. At New Caledonia, Meyer (1986) recorded *A. polycladia* (as *Comatella maculata*) from “relatively sheltered reefs” (p. 209), and *A. pectinifera* from “reefs subject to weak currents” (p. 206).

Most specimens of *A. pectinifera* described here are larger than previously recorded material. The largest collected (and several measured in the field) has a maximum ray length of about 500 mm, the longest recorded for any comatulid. Because posterior rays are substantially shorter (about 200 mm), the total span approximately equals that of the largest comatulid previously noted; the Arctic/boreal ante-

donid *Heliometra glacialis* var. *maxima* has rays up to 350 mm in length (Clark & Clark 1967).

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